Linearity of the BOLD Response to Varying Durations of Stimulus "OFF" Periods

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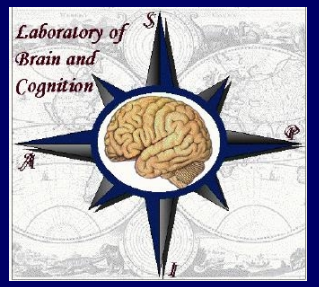


Purpose

- To characterize the linearity of the fMRI BOLD response to various durations of stimulus cessations (“OFF” periods).

Different stimulus “ON” periods

Tasks

Visual Stimulation

Durations

250ms, 500ms, 1000ms, 2000ms, 20s

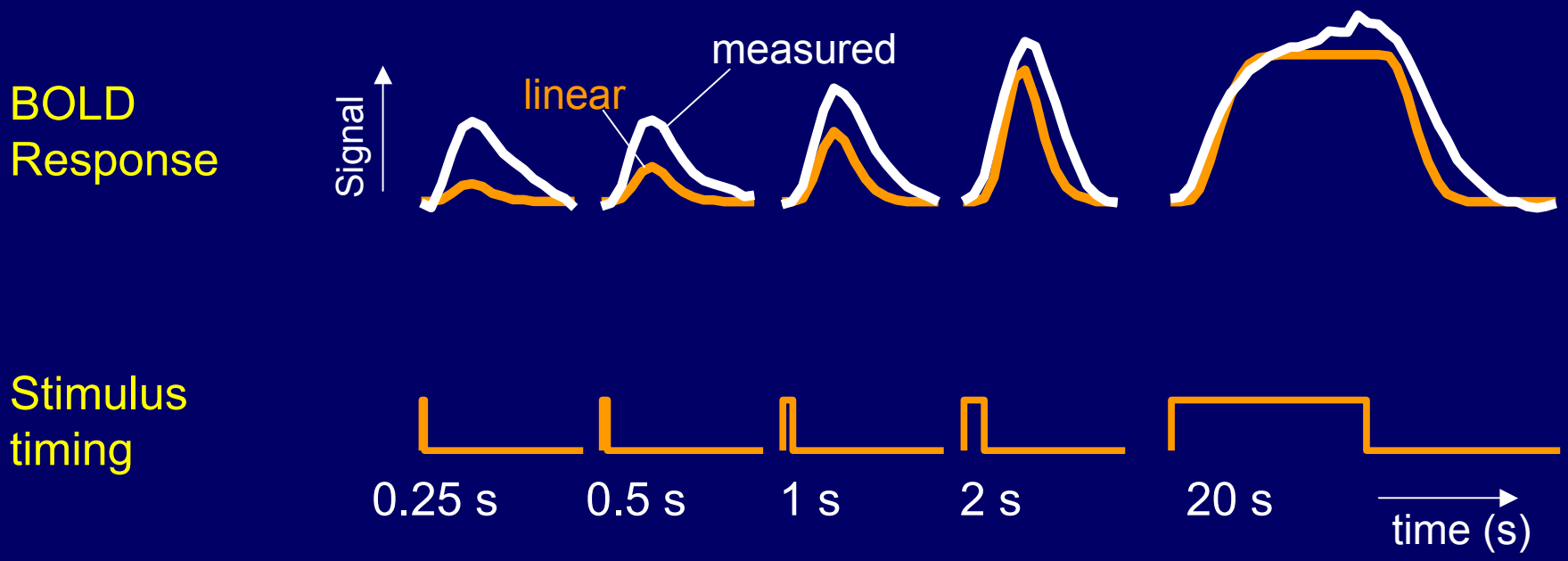
Imaging Parameters

3T GE Signa
EPI
64x64
24 cm FOV
5 mm slice thickness
8 slices

TR: 1000 ms
TE: 30 ms

320 time points

Different stimulus “ON” periods



Brief stimuli produce larger responses than expected

Different stimulus “OFF” periods

Tasks

Visual Stimulation

Durations

2 s, 3 s, 4 s, 8 s, 16 s

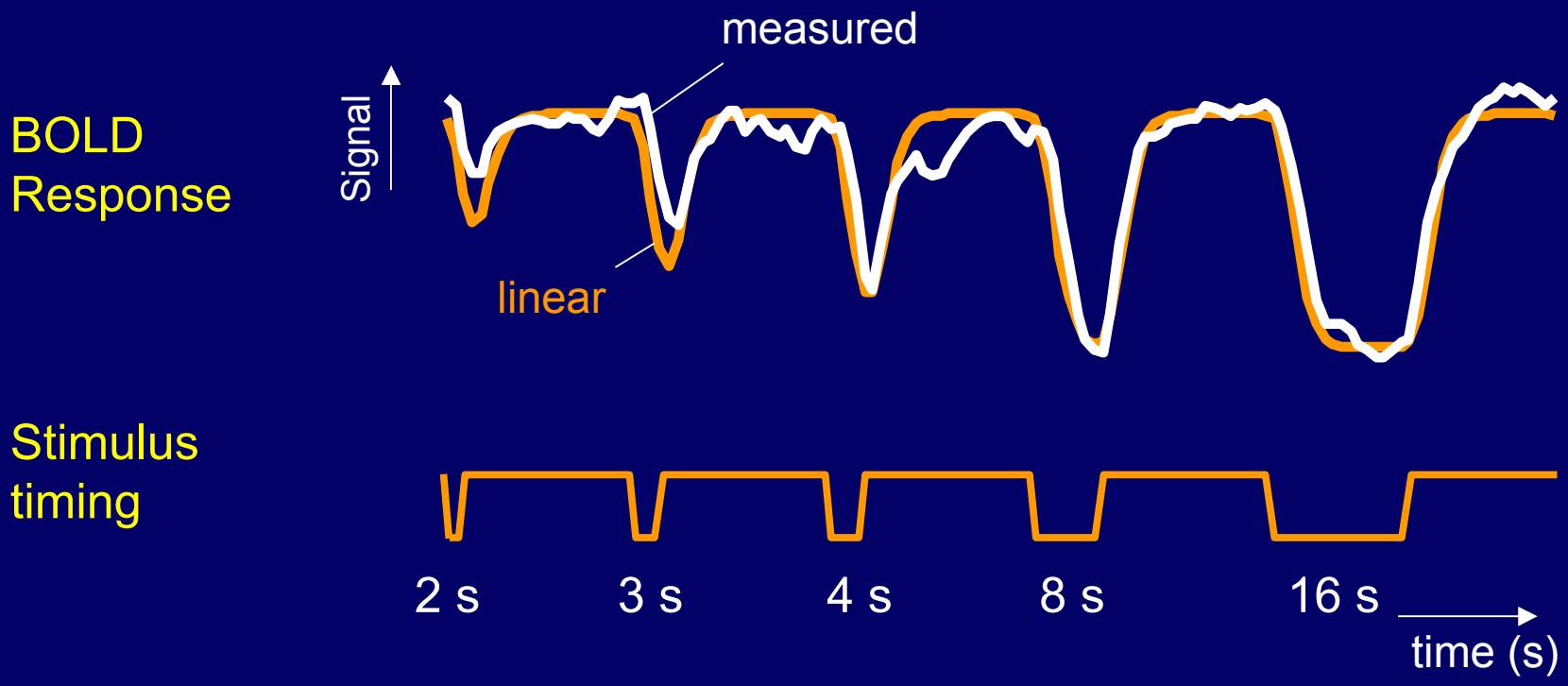
Imaging Parameters

3T GE Signa
EPI
64x64
24 cm FOV
5 mm slice thickness
8 slices

TR: 1000 ms
TE: 30 ms

310 time points

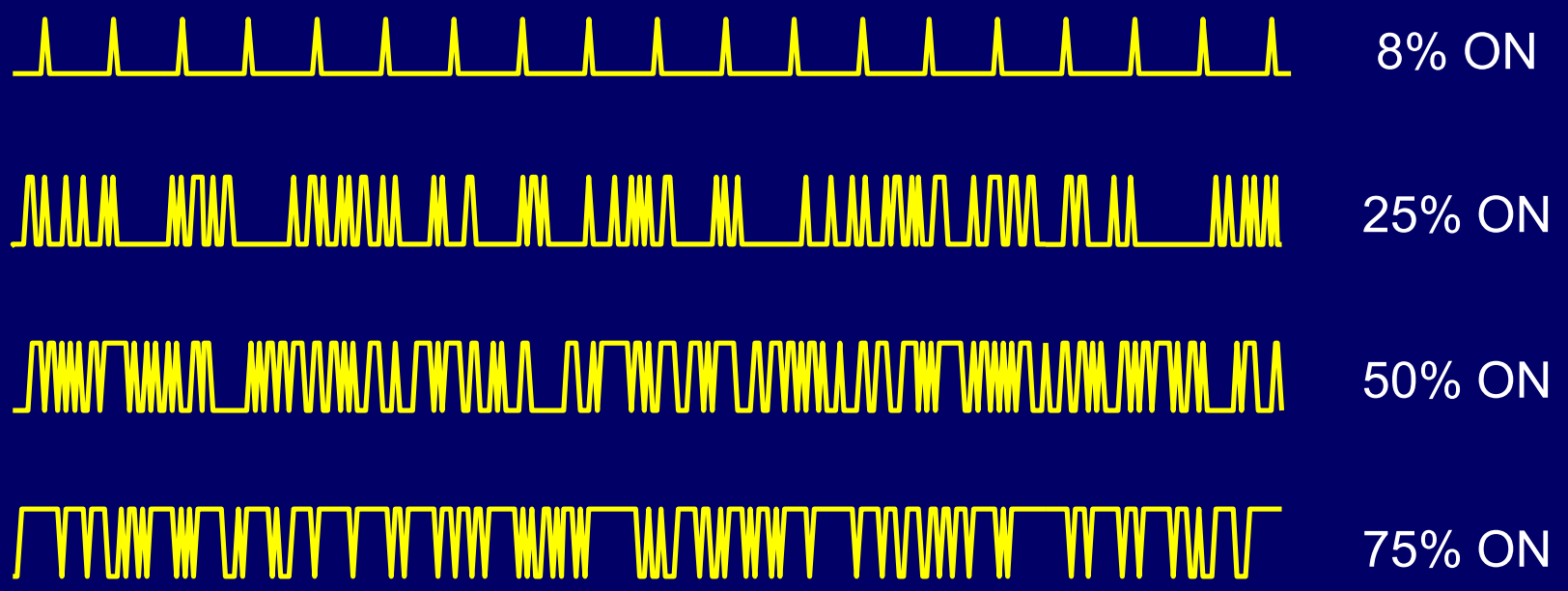
Different stimulus “ON” periods



Brief stimulus OFF periods produce smaller decreases than expected

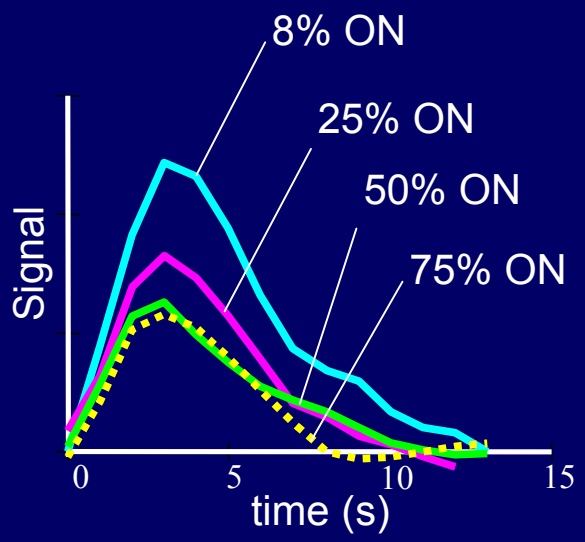
Varying “ON” and “OFF” periods

- *Rapid event-related design with varying ISI*

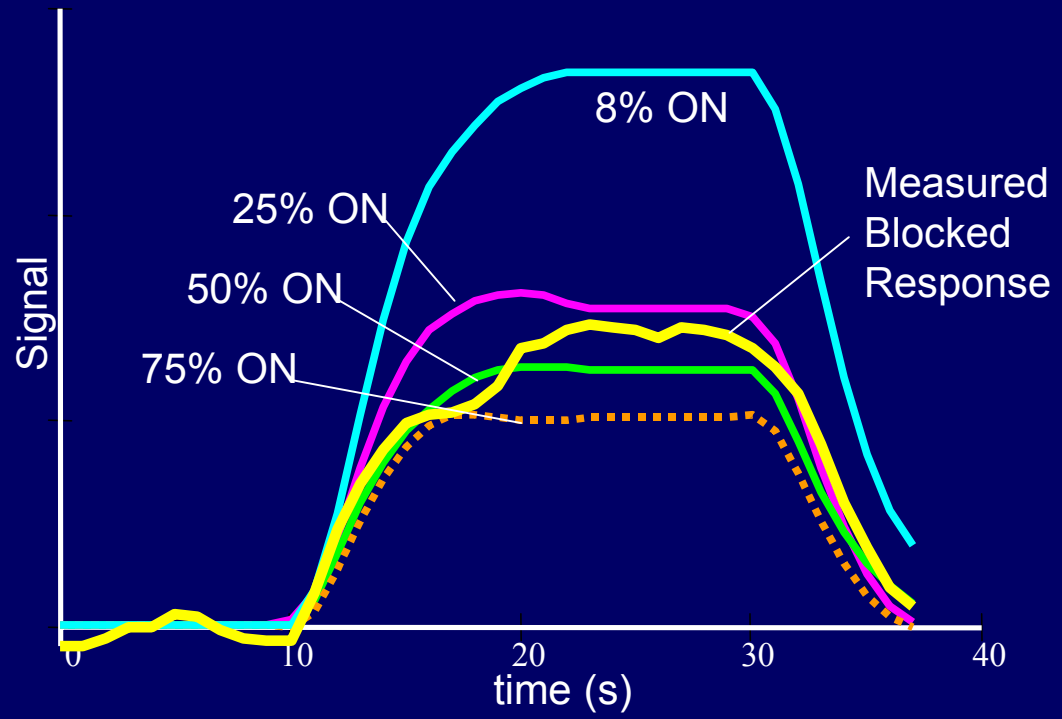


Varying “ON” and “OFF” periods

Estimated Impulse Response



Predicted Responses to 20 s stimulation



Conclusions

- For brief stimulus “ON” periods, signal increases are larger than expected
- For brief stimulus “OFF” periods, signal decreases are smaller than expected
- For varying “ON” and “OFF” periods, deconvolved impulse response depends on fraction of time in “ON” state.

Sources of this Nonlinearity

- Neuronal
- Hemodynamic
  - Oxygen extraction
  - Blood volume dynamics